THAPAR UNIVERSITY, PATIALA

Detailed Scheme
of
BE (Software Engineering and Management)

SCHOOL OF MATHEMATICS AND COMPUTER APPLICATIONS

BE (Software Engineering and Management)
Program Objectives:

Bachelor of Engineering (Software Engineering and Management) is an innovative programme offering a blend of software engineering and management education to provide the students:

- A combination of professional skills in Software Engineering and Business Management.
- Exposure to industry oriented approach by hands on experience of working on projects.
- Leveraging the knowledge and insight gained about business environment and industry dynamics.
- Develop entrepreneurial capabilities to become Techno-entrepreneurs.
- Understanding various functional areas such as, Software engineering, Finance, Human Resource, Operations etc. to prepare IT professionals for the industry.

Program Outcome:

After completion of course, students will have

- Necessary skills of software development and business management.
- Good exposure of industry research projects.
- Essential skills to become Techno-entrepreneurs.
- Better skills for management of various resources.

ELIGIBILITY: As per University Rules

Number of Seats: 30 No.

First year Semester I

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<tr>
<th>S.No.</th>
<th>Course No.</th>
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First year Semester II

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Course Objectives: To provide students with skills and knowledge in advanced calculus, calculus of several variables and vector calculus which would enable them to devise solutions for given situations they may encounter in their engineering profession. The mathematical skills derived from this course form a necessary base for analytical and design concepts encountered in engineering applications.

Successive Differentiation: Higher order derivatives, \( n^{th} \) derivatives of standard functions, \( n^{th} \) derivatives of rational functions, Leibnitz theorem.

Applications of Derivatives: Mean value theorems and their geometrical interpretation, Cartesian graphing using first and second order derivatives, Asymptotes and dominant terms, Graphing of polar curves, Polar equations for conic sections.

Sequences and Series: Introduction to sequences and Infinite series, Tests for convergence/divergence, Limit comparison test, Ratio test, Root test, Cauchy integral test, Cauchy condensation test, Absolute convergence and conditional convergence.

Series Expansions: Power series, Taylor series, Convergence of Taylor series, Error estimates, Term by term differentiation and integration, Multiplication and division process in power series.

Partial Differentiation: Functions of several variables, Limits and continuity, Chain rule, Change of variables, Partial differentiation of implicit functions, Taylor series of two variables, Directional derivatives and its properties, Maxima and minima by using second order derivatives.

Multiple Integrals: Change of order of integration, Change of variables, Applications of multiple integrals to areas and volumes.


Course Outcomes: After the completion of this course the student will be able to

- apply the knowledge of calculus to plot graphs of functions, approximate functions and solve the problem of maxima and minima.
- evaluate multiple integrals and their application to engineering problems.
- use vector analysis to calculate derivatives and integrals of vector-valued functions, relative positions, projections and work.
- evaluate integral theorems of Green, Gauss & Stokes to find lines, surfaces & volumes

Text Books


Reference Books

3.
Prerequisite(s): None

Course Objectives: To develop comprehensive, quantitative and analytical ability of the basic concept of physics useful to engineering students of different streams.

Vibrations and Acoustics: Kinematics of Simple Harmonic Motion, Damped and Forced Oscillations, Resonance; Reverberation, Sabine’s and Eyring’s formulae, Absorption coefficient, Conditions for good acoustical design, Production and Detection of Ultrasonic Waves and their Applications.

Electromagnetic Waves: Introduction, Concept of Displacement Current, Maxwell’s Equations, Electromagnetic Wave Equations in free space as well as conducting and dielectric media, Poynting’s theorem, Concept of Wave guides.

Optics: Interference: Thin films, wedge-shaped films, Non Reflecting films, Newton rings, Michelson interferometer; Diffraction: Single, Double and Multiple slits, Dispersive and Resolving Powers; Polarization: Production, detection and applications


Laboratory Work: Velocity of ultrasonic waves in liquids by stationary wave method, wavelength of sodium light using Newton’s ring, dispersive power of Na-D lines using diffraction grating, specific rotation of cane sugar solution, verification of Brewster’s law and Snell’s law, thickness of thin film using Michelson Interferometer, wavelength of a given He-Ne laser using diffraction grating, beam divergence and beam intensity of a given laser, application of Malus’ law, Young’s modulus using ultrasonic method, induced emf as a function of velocity of a magnet, resonance in series and parallel LCR circuits, time constant using sparking and quenching, power attenuation and guide wavelength of microwaves using Klystron tube, determination of Planck’s constant and confirmation of de Broglie hypothesis using Davisson-Germer experiment.

Course Outcomes: Understanding of

1. Mechanical vibrations and their applications as well as acoustics and their use in design of a hall.
2. Ultrasonic waves, Lasers as well as Interference, diffraction, and polarization and their industrial applications.
3. Maxwell’s equations and their applications in deducing several important parameters in different media.
4. Quantum mechanics and its engineering applications.

Text Books
Course Objective: To expose the students to the concepts of application of strength and serviceability aspects for designing rigid bodies subjected to elastic loading.

Equivalent Force Systems: Vector Algebra, Planar force systems, Coplanar collinear forces, Concurrent forces, Coplanar parallel forces, Basic concepts of force-couple systems, Varignon’s theorem, Simplest equivalent for general force system, Distributed force systems.

Equations of Statics and its Applications: Simple frictionless rigid body assemblies; Equations of equilibrium, free body diagrams, Support reactions, Two-force members; Plane trusses.

Axial Stress and Strain: Concept of stress and strain, Generalized Hooke’s law, Stress-strain diagram of ductile and brittle materials, properties of engineering materials, Statically determinate and indeterminate problems, Compound and composite bars, Thermal stresses.

Torsion of Circular shafts: Basic assumptions, Torsion formula, Power transmitted by shafts, Design of solid and hollow shafts based on strength and stiffness.

Shear Force and Bending Moment Diagrams: Types of load on beams, Classification of beams, Shear force and bending moment diagrams: Simply supported, Overhung and Cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment, Relationship between load, shear force and bending moment.

Theory of Pure Bending: Derivation of flexural formula for straight beams, concept of second moment of area, bending stress calculation for beams of simple and built up sections, Flitched beams.

Shear Stresses in Beams: Shear stress formula for beams, Shear stress distribution in beams.

Deflection of Beams: Governing differential equation for deflection of straight beams having constant flexural rigidity, double integration and Macaulay’s methods for slopes and deflection

Analysis of Plane Stress and Strains: Transformation equations for plane stress and plane strain, Mohr’s stress circle, Relation between elastic constants, Strain measurements, Strain rosettes.

Theories of Failure: Theories of elastic failure, graphical comparison of theories of failure.

Course Outcome: Te students would be able to:
- identify, analyze, and solve problems related to development of internal stresses and serviceability aspects
- undertake design problems on the basis of strength and serviceability concepts taught
- undertake experimental evaluation of material properties using both destructive and non-destructive techniques

LIST OF EXPERIMENTS

- Rockwell/Brinell hardness number of given specimens.
- Vicker’s hardness number test.
- Torsion test (destructive): to determine the torsional rigidity of the material.
- Tensile test on strip/universal testing machine – to obtain the young’s modulus of elasticity, tensile strength and percentage elongation of the material.
- Impact strength of the given material – Izod’s and Charpy tests.
- Experimentally determine the value of E of the beam material using deflections formula for cantilever and simply supported beams.
- Non-destructive torsion test to determine modulus of rigidity of the shaft material.
- To study the behavior of the material on UTM.
Text Books


Reference Books

UHU001 BUSINESS AND TECHNICAL COMMUNICATION

Prerequisite(s): None

Course Objective:
- To develop understanding regarding communication and its different media.
- To develop effective written, oral and non-verbal communication skills of the students.

Fundamentals of Communication: Definition, Two-way transactional model, Barriers to communication, Designing receiver-oriented messages, The cultural dimension of communication, Essentials of effective communication.

Improving interpersonal communication: Johari window; Transactional Analysis as tools.

Verbal and Non-verbal Channels of Communication

Spoken Communication: Importance of Spoken communication, Making an effective statement, Oral Presentations, Audience analysis, Defining objective, Collection of information, Organization of material, Effective delivery techniques.

Written communication: Writing as a process, Understanding the different forms of writing-Descriptive, Narrative, Expository, and Analytical. Choice of words, Effective sentence construction, Paragraph construction.

Technical writing - Business letters, resumes, report writing.

Reading: Accessing the written word, Ways to increase the effectiveness of reading.

Listening: Different types of listening, Techniques to be an effective listener.

Media of Nonverbal communication: Kinesics, Proxemics, Occulesiics, Paralinguistics, Chronemics, Haptics, Artifacts.

Formal and Informal Organizational Communication networks- Downward communication, Upward communication, Horizontal communication, Grapevine-informal communication network.

Literary discussion: ‘Lord of the Flies’ by William Golding.

Course Outcome:
- Increased understanding of the meaning of communication as removed from layman’s understanding.
- An increased appreciation of the differences in different modes of communication and selection of proper channel of communication.
- Better understanding of the importance of spoken communication and how to become a good speaker in group as well as individually.
- Improving interpersonal communication.
- Increased attention span as a listener.
- Learnt the unique characteristics of organizational communication and the various directional networks.
- Appreciation of the role of literature in our lives.

Lab work:
Presentations, group discussions, experiential learning exercises, case studies on communication, vocabulary building exercises, creative writing exercises
Software aided activities:
Proper pronunciation, learning to use the correct tense, awareness about common errors in usage of English.

Text Books


Reference Books

Prerequisite(s): None

Course Objectives: To inculcate the imagination and mental visualization capabilities for interpreting the geometrical details of common engineering objects. To impart knowledge about principles/methods related to projections of one, two and three dimensional objects.


Projection Systems: Projection Planes, Projection systems, Orthographic projections of points in first angle projection system and third angle projection system, Orthographic projections of lines on reference planes, True length of line using rotation of view method, Traces of lines, Auxiliary planes and their applications, Projections of Lamina parallel/inclined to reference planes, Projection of solids-Polyhedra, Solids of revolution, Sections of solids- Section plane parallel / inclined to reference planes, Intersection of solids.

Development of Surfaces: Development of surfaces like Prism, Pyramid, Cylinder, Cone, Sphere etc. using Parallel Line Method, Radial Line Method, Triangulation method.

Orthographic Projections: Extracting Orthographic projections from given pictorial views.

Isometric Views: Extracting Isometric projections from given Orthographic views using box method, Offset method.

Missing Lines and Missing Views: Evaluating missing lines and missing views from given orthographic views.

Computer Aided Drafting: Introduction to computer drafting tools like AutoCAD. Demonstration of commands like Line, Circle, Arc, Rectangle, MText and Dimensioning etc.

Course Outcomes: The students will be able to
- Imagine and visualize the geometric details of engineering objects.
- Translate the geometric information of engineering objects into engineering drawings.
- Use computer aided drafting in their respective engineering field.

Text Books

Reference Books
UTA003 COMPUTER PROGRAMMING

Prerequisite(s): None

Course objective: This course is designed to explore computing and to show students the art of computer programming. Students will learn some of the design principles for writing good programs.

Introduction to ‘C’ programming: Fundamentals, Structure of a ‘C’ program, Compilation and linking processes.

Expressions and Console I/O : Basic Data types, Identifier Names, Variables, Scope, Type qualifiers, Storage class specifiers, Constants, Operators, Reading and writing characters, Reading and writing strings, Formatted and console I/O, printf(), scanf(), Suppressing input.

Statements: True and False in C, Selection statements, Iteration statements, Jump statements, Expression statements, Block statements.

Arrays and Strings: Single dimension array, Two dimension array, Strings, Array of strings, Multi-dimension array, Array initialisation, Variable length arrays.

Pointers: Pointer variables, Pointer operators, Pointer expressions, Pointers and arrays, Multiple indirection, Pointer initialization, Pointers to arrays, Dynamically allocated arrays, Problems with pointers.

Functions: General form of a function, Understanding scope of a function, Function arguments, Command line arguments, Return statement, Recursion, Function prototype, Pointers to functions.

Structures, Unions, Enumerations, and Typedef: Structures, Array of structures, Passing structures to functions, Structure pointers, Arrays and structures within structures, Unions, Bit-fields, Enumerations, typedef.

File I/O: Streams and files, File system basics, fread() and fwrite(), fseek() and random access I/O, fprintf() and fscanf(), Standard streams.

Pre-processor and Comments: Pre-processor, #define, #error, #include, Conditional compilation directives, #undef, Single line and multiple line comments.

Laboratory work: To implement Programs for various kinds of programming constructs in C Language.

Text Books:

Reference Books:

COURSE OUTCOMES (COs)

| CO1 | To learn the implementation of simple ‘C’ program, data types and operators and Console I/O function. |
| CO2 | To learn the implementation of decision control statements, loop control statements and case control structures. |
| CO3 | To understand the declaration and implementation of arrays, pointers and functions. |
| CO4 | To learn the structures declaration, initialization and implementation. |
| CO5 | To understand the file operations, Character I/O, String I/O, File pointers and importance of pre-processor directives |
INTRODUCTION TO SOFTWARE ENGINEERING & MANAGEMENT PROFESSION

Prerequisite(s): None

Course objectives: The aim of this course is to introduce the profession of software engineering and management to first year engineering students. Also, to provide a road map to navigate through the complexities of the field of engineering in general and software engineering and management in particular.

Introduction to Engineering Discipline: Brief history and evolution, Relationship with pure science, mathematics, and other disciplines, General characteristics of engineering profession, Engineering design as a socio-psychological process, Major branches of engineering.

Software Engineering: Evolution, Science, practice and philosophy of engineering and software design, How it is different to computer science, Application of software engineering to science, business, economics and other branch of engineering, Social aspects of software engineering.

Role of Management in engineering: Overview of management functions, Importance of management in engineering, Need of Engineering and Management as integrated discipline, Function of software engineering and management amongst other branches of engineering.

Engineering & Management as a profession: Introduction to engineering & management, Development, roles and responsibilities of a professional, Software engineering & management as a profession, Engineer to manager transition, challenges and opportunities, Difference between technical and managerial competence, Career prospects of Software Engineering and Management professionals.

Course Outcomes: After completing this course, students will be
  - Able to appreciate the profession of engineering
  - Understand the value of synergy between engineering and management
  - Recognize the link between software engineering and other branches of engineering
  - Able to develop themselves as a software engineering and professional

Text Books:
1. Engineers becoming managers: From the classroom to the boardroom by Peter C. Hughes, Xlibris Publishers, (2006).

Reference Books:
Course Objectives: To introduce students the theory and concepts of ordinary and partial differential equations, linear algebra and complex analysis which will equip students with adequate knowledge of mathematics to formulate and solve problems analytically

Linear Algebra: Row reduced echelon form, Solution of system of linear equations, Matrix inversion, Linear spaces, Subspaces, Dimension and basis, Linear transformation and its matrix representation, Eigen-values, Eigen-vectors, Diagonalisation, Special type of matrices and their properties.

Complex Variables: Basics of complex plane, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Elementary functions, Exponential, Trigonometric, Hyperbolic and their inverses, Complex exponents.


Laplace Transform: Definition and existence of Laplace transforms and its inverse, Properties of the Laplace transforms, Unit step function, Impulse function, Applications to solve initial and boundary value problems.

Fourier Series: Introduction, Fourier series on arbitrary intervals, Half range expansions, Applications of Fourier series to solve wave equation and heat equation.

Course Outcomes: After the completion of this course the student will be able to

- solve differential equations of first and 2nd order using various analytical methods.
- solve ordinary and partial differential equations using the Laplace transform and Fourier series
- apply the concept and consequences of analyticity and the Cauchy-Riemann equations on harmonic and entire functions.
- solve systems of linear equations and analyze vectors in R^n geometrically and algebraically.
- analyze vector spaces and subspaces over a field, and to find linear transformations and their properties, matrices of linear transformations

Text Books:


Reference Books:

Prerequisite(s): None

Course objective: The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.


Electrochemistry: Migration of ions, Transference number, Determination of Transference number by Hittorf’s method, Conductometric titrations, Types of electrode: Calomel and glass electrode, Liquid junction potential, Potentiometric Titrations.

Fuels and Battery: Classification of fuels, Calorific value, Cetane number, Octane number, fuel quality, Comparison of solid liquid and gaseous fuel, properties of fuel, alternative fuels: biofuels, Power alcohol and synthetic petrol, Battery, Photovoltaic cell, Metal-air battery, Lithium and nickel battery.

Spectroscopic Techniques: Beer-Lambert’s law, Introduction to atomic and molecular spectroscopy, Principle, instrumentation and applications of atomic absorption, atomic emission, UV-Vis and IR spectroscopy.

Phase Rule: Introduction to Phase, Component and Degree of freedom, Derivation of phase rule, One component and two component systems.

Chemistry of Polymers: Overview of polymers, Types of polymerization, Molecular weight determination, Industrial applications of polymers in fiber, paints and coatings, Conducting polymers. Biodegradable Polymers, Polymers in automotive industry.


Laboratory Work: Experiments involving use of pH meter, conductivity meter, potentiometer, colorimeter, UV-Vis spectrophotometer and melting point apparatus. Determination of hardness, alkalinity, chloride, chromium, iron and copper in aqueous medium, and properties of fuel.

Course outcome: The students will acquire knowledge of

1. Different types of polymers, engineering and nanomaterials and their applications
2. Approach to demonstrate the working of electrodes, working and uses of classical batteries.
3. Differentiate various types of corrosion, and gain knowledge on control measures associated with corrosion
4. Principles underlying various methods of water and instrumental analysis.
Text Books:


Reference Books:

Course Objectives: To introduce basic manufacturing processes used in industry. To identify, analyze, and solve problems related to basic manufacturing processes both independently and as a part of a team.

Introduction: Common engineering materials and their important mechanical and manufacturing properties, General classification of manufacturing processes.

Metal Casting: Principles of metal casting, Patterns, Their functions, Types, Materials and pattern allowances, Characteristics of molding sand, Types of cores, Chaplets and chills, their materials and functions, Moulds and their types, Requisites of a sound casting, Introduction to Die Casting.


Machining Processes: Principles of metal cutting, Cutting tools, their materials and applications, Geometry of single point cutting tool, Cutting fluids and their functions, Basic machine tools and their applications, Introduction to non-traditional machining processes (EDM, USM, CHM, ECM, LBM, AJM, and WJM).

Joining Processes: Electric arc, Gas, Resistance and Thermit welding, Soldering, Brazing and Braze welding, Adhesive bonding, Mechanical fastening (Riveting, Screwing, Metal stitching, Crimping etc.).

Plastic Processing: Plastics, their types and manufacturing properties, Compression molding, Injection molding and Blow molding, Additives in Plastics.

Modern Trends In Manufacturing: Introduction to numerical control (NC) and computerized numerical control (CNC) machines.

Laboratory Work: Relevant shop floor exercises involving practice in pattern making, Sand casting, Machining, Welding, Sheet metal fabrication techniques, Fitting work and surface treatment of metals, Demonstration of Forge welding, TIG/MIG/GAS/Spot/Flash butt welding, Demonstration on Shaper, Planer and Milling machine.

Course Outcomes: The students will be able to
- Identify and understand the basic manufacturing processes like single and multipoint machining, forming, welding, casting etc.
- Acquire basic operational skills in different manufacturing processes like machining, forming, welding, casting, sheet metal operations, pattern making etc.

Course Outcomes:
The students will be able to
- Identify and understand the basic manufacturing processes like single and multipoint machining, forming, welding, casting etc.
- Acquire basic operational skills in different manufacturing processes like machining, forming, welding, casting, sheet metal operations, pattern making etc.

Text Books:
Reference Books
Prerequisite(s): None

Course Objectives: To understand the first, second law of thermodynamics, availability, the concept entropy change and entropy generation as applied to a variety of engineering systems.


First Law of Thermodynamics: Concept of internal energy & enthalpy, Energy equation as applied to a close and open system, PMMI, Transient flow processes.


Thermodynamic Cycles: Rankine cycle, Vapour compression refrigeration cycle, Air standard cycles: Otto, Diesel Cycle

Boiler: Classification of boilers, Comparison of water and fire tube boilers, Mounting and Accessories with their functions, Constructional and operational details of water and fire tube boilers, Concept of the fluidized bed boiler.


Course Outcomes: The students will be able to
- Understand the basic principles of thermodynamics like conservation of mass, conservation of energy and the second law of thermodynamics.
- Formulate and solve engineering problems involving closed and open systems for both steady state and transient processes.
Analyze the performance of various power cycles and to identify methods for improving thermodynamic performance.

Text Books

Reference Books
BIOLOGICAL APPLICATIONS IN ENGINEERING

Prerequisite(s): None

Course objective: To provide an overview of biological systems and their applications in engineering; integrates the expertise of fundamental engineering fields with expertise from non-engineering disciplines.

Course contents: Overview of living forms and biomolecules applications of biological systems, processing and production, bioreactors, bioseparations engineering, membrane based bioseparations. Overview of field of bioengineering, engineering analysis and design of biological systems, biomechanics, systems and synthetic biology, physical biology, biomolecular engineering, tissue engineering and devices, quantitative methods applied to biology, Biotechnologies development and applications and their benefits: positive and negative, basic principles of ethics concerning new technologies; Applications of whole cell and enzymes in biomolecular electronics, biosensors, Engineering tools in simulation studies, informatics and nanotechnology. Integration of biology and medicine with engineering across different levels of the biological hierarchy and their applications.

Course outcome: The students will be able to integrate engineering with biological systems and their importance and understand underlying principles.

Recommended Book:

5. Principles of Bioseparation Engineering by Raja Ghosh (McMaster University, Canada)
6. An Introductory Text To Bioengineering edited by Shu Chien, Peter C Y Chen & Y C Fung (University of California, San Diego, USA)
INTERNET AND JAVA PROGRAMMING

L T P Cr
3 0 2 4.0

Prerequisite(s): None

Course objective: Understand fundamentals of object oriented programming in java. To help students understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.

Introduction to Internet: Internet Application, E-mail Architecture & Services, The server side, Creating and locating information on the web, URL’s, HTTP protocol, Web browsers, Web site and Web page design, HTML, Dynamic HTML, CGI, Java script, search engines and web casting Technique, popular web servers, basic features bookmarks, cookies, browsing tricks, search tools, case study of IE.

Introduction to Java: History and Evolution of Java, Java Vs. other popular languages, The java programming environment, Fundamental Programming structures: Data types-Primitive Types, Floating-Point Types, Literals, Variables, Type Conversion and Casting, Arrays, Operators-Arithmetic, Bit Wise, Relational, Boolean; Expressions, Statements and Blocks, Control flow statements- Selection, Iteration and Jump Statements.

Object Oriented Programming Concepts in Java: Objects and Classes, declaring Objects, Constructors, This keyword, Method Overloading, Constructor Overloading, Nested classes.

Inheritance: Defining, Applying and Implementing Interfaces; Method Overriding, Super and Final keywords, Polymorphism, Generics, Defining, finding and importing Packages, Exceptions Handling with try, catch, throw, throws and finally keywords, Wrapper classes.

I/O and Threads: Binary I/O, File Handling, Communicating with internet, Thread Model, Creating a thread, Synchronization, Inter-thread Communication, Thread Lifecycle.

Building GUI in Java: Layout Managers, SWING features and Components, Painting, using images, performing animations. Borders, Icons, Event Handling, implementation of Listeners for event handling.

Laboratory work: Main focus is on implementing basic concepts of object oriented programming and to enhance programming skills to solve specific problems.

Text books:

Reference books:

COURSE OUTCOMES (COs)

| CO1 | To understand the basics of Internet, E-mail and allied Services. |
| CO2 | To learn the implementation of decision statement and looping statements. |
| CO3 | To understand concepts of Object Oriented Computing in Java. |
| CO4 | To understand Input and output handling from console, files and internet in Java. |
| CO5 | To learn creation of frames, windows, containers, GUI components in Java and event handling for building GUI. |
BIO-COMPUTING AND GENETIC ENGINEERING

Prerequisite(s): None

Course objectives: The course is designed to make students find and further explore the significance of information in biological systems. The students will learn about storage, reproduction and transmission of genetic information. They will extensive learn about genome complexity and sequence analysis by applying various algorithms.

Genetic information: Structure and properties of DNA, Chargaff's rule and sequence complementarity, storage, copying and deciphering genetic information, genetic code, ORF, gene promoter and other cis-elements, protein sequence and structure relationship, genome complexity analysis by re-association kinetics of genomic DNA, mutations and their role in evolution, Recombinant DNA technology, cutting and joining of DNA, hybrid DNA and transformation.

Sequence alignment: Concept of sequence alignment, gap penalty, scoring matrices, scoring model, log odds ratio, mutation probability matrix, BLOSUM matrix calculation, pairwise sequence alignment, dot matrix method, global and local alignment, Needleman-Wunsch algorithm of global alignment, Smith-Waterman algorithm of local alignment, heuristic methods of sequence alignment viz. FASTA and BLAST

Multiple sequence alignment: scoring a multiple alignment, SP scores and minimum entropy methods, dynamic programming approach, heuristic alignment methods – progressive alignment, iterative refinement methods, genetic algorithm and multiple alignment by profile HMMs


Course outcomes: After successful completion of the course students will have in depth knowhow of sequence analysis based on pairwise and multiple sequence alignments and the algorithms involved in it. They would also be able to perform phylogenetic analysis for various applications such as learning about evolutionary relationships.

Recommended Books
Prerequisite(s): None

Course Objectives: To impart basic knowledge about nuclear properties, behaviour and related topics for overall understanding of nuclear power generation.

Review of Nuclear Physics: Characteristics of atomic nucleus, Binding energy, Nuclear size and shape, Nuclear fission, Interaction of neutrons with nuclei, nuclear cross-sections.


Fission Process and diffusion theory: Prompt neutrons, Fast fission, Fission energy, Thermal utilization, Fission products, Chain reaction, Multiplication factor, Leakage of neutrons, Critical size, Diffusion and slowing down theory, Homogenous and heterogeneous reactors.


Control requirements: Control requirement calculations, Means of control, Reactor kinetic: Neutron lifetime, Generation time, Point kinetic equation and solution of the equations for step input reactivity.

Nuclear Power reactors: Boiling water reactors, Pressurized heavy water reactors, Gas cooled reactors, liquid metal cooled reactors and Fast breeder reactors. Plasma states, Possibility of nuclear power production via fusion process.


Safety Aspects: Radiation dose unit, Safety limits, Dose calculations, Design consideration of simple shields.

Course Outcome: Understanding of

1. Primary aspects of nuclear phenomena and production of energy via fission and fusion processes.
2. How to manage the nuclear fuel and waste.
3. The related safety aspects.

Text Books:
- Krane K.S. Nuclear Physics, Wiley India Pvt. Ltd. (2008).
- Glasstons Sammuel and Sesonske Alexander, Nuclear reactor Engineer, CBS publishers & distributors (1986).
Prerequisite(s): None

Course Objective: To introduce structure, function and properties of some biologically important molecules and applications of biological chemistry.


Bioenergetics: Biological systems and general laws of thermodynamics, Concept of entropy, High energy bonds, Biological oxidation and redox potentials, Mitochondrial electron transport chain.

Amino acids and proteins: Physical and chemical properties of amino acids, Titration curves, Peptide bond, Folding of peptide chains into regular repeating structure (α-helix, β-pleated sheets), β-turns in polypeptides, Amino acid sequencing of poly peptides, Native proteins and their conformations, Forces stabilizing structure, Shape of proteins, Denaturation of proteins.

Heme and non-heme metalloproteins: Haemoglobin and myoglobin as oxygen carriers, Bohr effect, Coordination chemistry of Fe(II) in haemoglobin and oxyhaemoglobin, Relaxed and tense configurations of haemoglobin, Electronic formulations and mode of bonding of dioxygen in haemoglobin, cytochromes, iron supply and transport in biological systems, Ferritin, Transferrin. Metal deficiency and disease, Toxic effects of metals, Metals used for diagnosis and chemotherapy.


Course Outcome: The student will acquire the knowledge of
1. origin of life.
2. molecular level reactions, energies and arrangement of cell organelles.
3. processes involved in the living systems for betterment of society.

Text Books

Reference Books
CHEMICAL ANALYTICAL TECHNIQUES

Prerequisite(s): None

Course Objective: To provide fundamental knowledge of different chemical analytical techniques and related concepts.

Tools of Analytical Chemistry: Data Handling: Accuracy and precision, Significant figures, Rounding off, Determinate and indeterminate errors, Ways of expressing accuracy, Standard deviation, Significant errors and propagation of errors, Control charts, Confidence limit, Test of significance, Rejection of a result, Q-Test, Statistics for small sets of data, Linear least squares fitting, The correlation coefficient of detection limit, Statistics of sampling problems. Sampling, Standardization and Calibration: Analytical samples and methods, Sampling and sample handling, Standardization and calibration, Figure of merit for analytical methods.


Thermal and Chromatographic Methods of Analysis:

Introduction: Thermogravimetry (TGA), Differential thermal analysis (DTA). Partition based chromatographic methods.

Course Outcome: The candidates shall acquire
1. the fundamental knowledge of tools of analytical chemistry like data handling, sampling, standardization, calibration and stoichiometric calculations.
2. the knowledge of classical, electrochemical and spectrochemical methods of analysis.
3. introductory knowledge of thermal and chromatographic methods of analysis.

Text Books
Reference Books
